March 4, 1004

Remarks of Dr. Nathaniel Pitts, (USA)
Plenary 5, International S&T Networks

"How can cross-border cooperation enhance S&T capabilities to deliver sustainable growth in APEC economies?"

Although we could discuss this very rich topic for days, in the few minutes available I will touch on just a few aspects.

International cooperation in **information technology (IT) itself** can be at various levels of technological sophistication, from enabling basic connectivity to high-performance networking.

NSF has been instrumental in bringing electronic communications capacity to scores of developing countries. Since the late 1980's, NSF has funded the Network Startup Resource Center (NSRC), a non-profit organization that has helped design and deploy computer networks in all regions of the world, enabling academic to gain access to the Internet. Going beyond connectivity, NSRC helps the host countries build the physical and human infrastructure to maintain and expand information and communications capability, with benefits that quickly expand beyond their scientific community.

For economies at more advanced levels of IT capacity, international collaboration can push forward the cutting edge. PRAGMA, the Pacific Rim Applications and Grid Middleware Assembly, is a partnership of 14 high-performance computing institutions in China, Australia, Singapore, Japan, Thailand, Malaysia, Korea, Chinese Taipei, U.S., and India. PRAGMA promotes cooperation in grid technology and regional standards development to make grid-enabled computing and resource-sharing a reality. PRAGMA has played a role in some of the examples I'll mention later.

NSF supports a multitude of international research networks; typically they are characterized by free exchange of data and findings, shared databases, and exchange visits of researchers and students. I'll describe just a few examples that relate to sustainable growth.

Research into new materials and processes will play an ever increasing role in improving energy efficiency, promoting environmental protection, lowering health-care costs, developing an information infrastructure, providing modern and reliable transportation and civil infrastructure systems, and strengthening security worldwide. NSF is supporting the creation of an Internet-based worldwide materials research network to enhance scientific and educational collaborations. With this objective, a series of five international workshops have been sponsored to date, covering almost all the continents and regions of the world, to help create networks linking the participating countries.

Current work in **Plant Genome Research** builds on the work of the Multinational Coordinated *Arabidopsis* Genome Research Project, which completed the first sequencing of a plant genome in 2000. *Arabidopsis* is a weed in the mustard family that has emerged as the plant counterpart of the laboratory mouse. The *Arabidopsis* genome sequence provided the frame of reference for the recently completed rice genomic sequence. The next phase of *Arabidopsis* research will be to determine the function of every gene. This research will serve as a basis for comparative studies with more economically important agricultural species. The Arabidopsis project is a major international effort that involves over 2,500 laboratories and 8,000 scientists worldwide. Participating scientists and scientific administrators come from Asia, Australia, Europe, the Middle East, and the Americas, and more countries have expressed interest in joining.

My next example is the **Global Biodiversity information Facility, GBIF,** which was established in 2000, with endorsement by the OECD, by a consortium of 28 countries and intergovernmental organizations. To support sustained growth, informed stewardship of our biological resources is essential. Because biodiversity information is not immediately at hand, it is often not applied in policy or management decisions, nor is that information readily accessible by research scientists. Biodiversity is distributed all over the earth, with the highest concentration in tropical regions, especially in developing countries, and in the oceans. In contrast, scientific information about biodiversity is largely concentrated in major centers in developed countries. Through GBIF, the intent is to change that, by making the biodiversity data held in natural history museum collections, libraries and databanks available to anyone, anywhere, who has access to the Internet. In the long term, databases at various scales can be linked to the system. The ability to access and navigate this information is vital to generating economic, environmental, social and scientific benefits from the sustainable use, conservation and study of biodiversity resources.

Turning to the health sector, we have an example from last year's battle to contain the SARS virus. Quarantine and isolation are the primary means of slowing the spread of SARS. However, quarantine presented hospitals in Chinese Taipei with a communications crisis. In May 2003, Chinese Taipei's National Center for High-performance Computing (NCHC) sent an urgent request to PRAGMA (the Pacific Rim Applications and Grid Middleware Assembly). PRAGMA participating scientists assisted Chinese Taipei in developing a cutting-edge communication access grid among quarantined Taiwanese hospitals. This linked hospitals to each other and to the most up-to-date global sources of health information. The grid went beyond the standard video- and teleconferencing, and allowed physicians to share detailed x-ray images, patient data, and other information in on-line meetings among several sites. According to NCHC's director, this partnership assisted in fighting the disease, relieving the epidemic, and ultimately saved many lives.

As an example of collaborative **environmental research**, the **International Long Term Ecological Research (LTER)** network., comprises multiple sites in 25 countries. This network provides a platform for comparative studies of grasslands, forests, lakes, deserts, rivers, coastal zones, and even a few urban areas, across temporal and geographic boundaries. Data-collection activities and field experiments provide insights into the ways that different ecosystems respond to environmental changes, short- or longer term, human-induced or naturally-occurring. This understanding of how specific human and environmental factors interact is of potential value to environmental policymakers, resource managers and land use planners. In one project, LTER sites in the US and in Japan, China, and Chinese Taipei are studying factors that affect the health of lakes. PRAGMA is helping the sites to conduct sensor-based lake monitoring and analysis. Continuous monitoring at multiple sites provides the opportunity for discovering patterns and understanding the relationships between variables.

Earthquake engineering research is one component of cooperation in **hazards prediction and mitigation.** Although earthquakes cannot be prevented, improved planning and design of man-made structures can mitigate damage when earthquakes occur.

NSF is developing a Network for Earthquake Engineering Simulation (NEES) to support broad community collaboration in earthquake engineering research and education. When construction is completed in fall of 2004, NEES will be a networked simulation resource of 15 shared-use experimental research equipment sites, geographically-distributed around the U.S., with tele-observation and tele-operation capabilities. International partners are encouraged to participate in the NEES network, so that these resources will be available to researchers worldwide. A number of researchers at earthquake engineering institutions in APEC member economies have already expressed interest in joining. NEES offers a unique opportunity for collaborative research on large-scale, systems level problems that have not been able to be studied in the past. With NEES, the integrated data and communications systems will permit participation from any point that can access the Internet, thus facilitating both domestic and international collaborations, and enabling the best research teams to study common problems, even though separated by geography.

NEES may provide a model for future cooperation world-wide. With modern information technologies, it will be possible to build international partnerships to study common problems in real time in the laboratory for a wide range of problems that go well beyond earthquake engineering.